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(54) Title: SYSTEM AND METHOD FOR SHORT MESSAGE DELIVERY BETWEEN GSM AND TDMA NETWORKS

(57) Abstract

A method and apparatus for interconnecting a first network (10) using a first SMS message protocol and a second network (15) using a second SMS message protocol to enable SMS message transmissions between the first and second networks. A node (20) interconnects the first and second networks and is configured to receive SMS message from each of the networks. The node (20) includes a module (25) responsive to the receipt of SMS messages (65, 135) from the first and second networks to extract SMS data from the SMS message (65, 135) in a first format and format the extracted SMS data into a second SMS message (75, 145) for the other network in a different format. The reformatted message (75, 145) is then transmitted to the other network.

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SYSTEM AND METHOD FOR SHORT MESSAGE DELIVERY BETWEEN GSM AND TDMA NETWORKS

RELATED APPLICATIONS

This application claims priority from and incorporates herein by reference the entire disclosure of U.S. Patent Application Serial No. 60/124,918, filed March 17, 1999.

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates to the delivery of short message service (SMS) messages, and more particularly to a system and method for delivering SMS messages between GSM and TDMA networks.

Description of Related Art

Within cellular networks, a mobile subscriber may roam between service areas of different networks. Various techniques have been developed to enable a mobile subscriber to continue being provided with mobile telephone services once they have left their home service area. In a first alternative, once a mobile subscriber travels into a new mobile switching center (MSC) coverage area and turns on their mobile station for the first time, the mobile station attempts to register with the servicing MSC for the area by transmitting an associated identification number known as the international mobile subscriber identity (IMSI) number or mobile identification number (MIN). The serving MSC communicates with the home location register associated with the mobile station using the received IMSI/MIN. This communication is to inform the HLR of the mobile station's new location and to receive requisite subscriber information from the HLR necessary to provide mobile services to the newly registering mobile station.

However, when mobile subscribers move between networks utilizing different technologies, for example, a GSM system utilizing a GSM MAP protocol and a TDMA system using a ANSI-41 protocol, the various information required to be

transmitted between the networks creates problems in converting information between the protocols useable by each system.

One problem arising with subscribers roaming between GSM and TDMA networks is the inability to deliver short message service messages to a subscriber which has roamed outside of its home network into a second network which utilizes a differing technology. Short message service messages within GSM and TDMA networks are formatted according to different protocols which will not seamlessly pass between the networks. Current implementations of intertechnology roaming do not support short message service delivery between GSM and TDMA networks. Thus, when a subscriber from a GSM or TDMA network roams into a TDMA or GSM network, respectively, they are no longer able to receive SMS messages until they return to their home network. Some method for enabling a GSM or TDMA subscriber to continue to receive SMS messages once they have roamed into a different network would provide a greatly desirable additional service to the subscriber.

SUMMARY OF THE INVENTION

The present invention overcomes the foregoing and other problems with a method and apparatus for interconnecting a GSM network using a GSM SMS message protocol with a TDMA network using an IS-136 SMS message protocol to enable the seamless transmission of SMS messages between the GSM and TDMA networks. Upon receipt of an SMS message from the GSM network by a mobility gateway connected to the network, SMS data is extracted from the SMS message which is in GSM format. The extracted SMS data is formatted into an SMS message in IS-136 format and is transmitted to the TDMA network as an SMS delivery point-to-point invoke message. Upon receipt of an SMS message from the TDMA network by the mobility gateway, SMS message data is extracted from the IS-136 formatted SMS message. The extracted SMS data is then reformatted into a GSM protocol SMS message. The reformatted SMS message is transmitted to the GSM network as a forward short message invoke message from the mobility gateway.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a functional block diagram illustrating a mobility gateway including the functionality of the present invention between a GSM network and a TDMA network;

FIGURE 2 is a signaling diagram illustrating the delivery of an SMS message to a GSM subscriber roaming within a TDMA network; and

FIGURE 3 is a signaling diagram illustrating the delivery of an SMS message to a TDMA subscriber roaming within a GSM network.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the Drawings, and more particularly to FIGURE 1, there is illustrated a block diagram of a GSM network 10 utilizing a GSM MAP protocol interconnected with a TDMA network 15 using a ANSI-41 protocol through a mobility gateway 20. The GSM network 10 enables subscribers to access telecommunications functionalities utilizing GSM technologies. The TDMA network enables mobile subscribers to access telecommunications functionalities using TDMA technologies.

The mobility gateway 20 enables mobile subscribers from the GSM network 20 to roam within the TDMA network 15 and mobile subscribers from the TDMA network to roam within the GSM network 10 while maintaining access to substantially all of the services and functionalities provided to them within their home network. While the present system is described with respect to interconnections between a TDMA system using the ANSI-41 protocol and a GSM system utilizing a GSM MAP protocol, it should be realized that the mobility gateway 20 and discussions with respect thereto may be extended to include other mobile protocols and networks such that the described system is not limited to use between GSM and TDMA networks.

In order to enable the transmission of SMS messages between GSM networks and TDMA networks, an SMS message delivery functionality 25 is implemented within the mobility gateway 20. The SMS message deliver functionality 25 receives

SMS messages from both the TDMA and GSM networks and converts the message from the protocol used by the transmitting network to the protocol used by the receiving network. In this manner SMS messages may be seamlessly transmitted between GSM and TDMA networks.

In the case of an SMS message being received from a TDMA network and converted to a GSM SMS message, once an SMS delivery point-to-point invoke message is received from a TDMA network, the SMS message delivery functionality 25 confirms that the message is capable of being converted and transferred to the GSM network. The SMS message delivery functionality 25 extracts the short message data from the SMS delivery point-to-point invoke parameter "SMS bearer data". This information is structured in an IS-136 SMS deliver message and contains the following parameters: message type indicator, message reference, privacy indicator, urgency indicator, delivery acknowledgment request, manual acknowledgment request, message updating, validity, display time, user data time, message center time stamp, SMS signal, call back number, call back number presentation indicator, call back number alpha tag, multilingual call back number, multilingual call back number alpha tag, language identifier, and acknowledgment time. Using this extracted information, an SMS-RP-UI parameter is created and transmitted within the forward short message in GSM format to the GSM network.

The SMS-RP-UI parameter is composed of a transport protocol SMS-Deliver message and contains the following parameters: Message Type Indicator (set to value "SMS-Deliver"); More Messages to Send (set to value "No more messages or waiting for the MS in this SC"); Reply Path (set to value "TP-Reply-Path is not set in this SMS-Deliver"); User Data Header Indicator (set to value "The TP-PDU field contains only the SM"); Status Report Indication (set to value "A status report is not requested"); Originating Address (The address of the original SME. Use of the value received in parameter "SMS Original Originating Address" of message "SMS Delivery Point to Point Invoke". Set the type of number to international (add prefix if received number is in national format) and the number plan to E.164. If the parameter was not received or the encoding is not BCD, send a dummy address.); Protocol Identifier (set to value "0"); Data Coding Scheme (Use message encoding value "Default Alphabet"

if received parameter Encoding Identified has value "IRA" or "Latin-1", otherwise use value "8-bit". Use message class value "Class 1" if received parameter Urgency Indicator has value "Very Urgent", otherwise use value "Class 1".); Service Centre Time Stamp (Created by the MG. Two messages for the same subscriber must have a different time stamp.); User Data Length (number of characters); User Data (The IS-136 SMS message (parameter User Data) converted to the GSM default alphabet, unless it is sent as 8-bit data. Truncate message length if longer than 134 octets (152 characters).) Upon receipt of a forward short message invoke from the GSM network, short message content are extracted from the forward short message invoke parameter SM-RP-UI by the SMS Message Delivery Functionality 25. The SM-RP-UI parameter is structured as a GSM transport protocol SMS deliver message and contains the parameters: Message Type Indicator; More Messages to Send; Reply Path; User Data Header Indicator; Status Report Indication; Originating Address; Protocol Identifier; Data Coding Scheme; Service Centre Time Stamp; User Data Length; and User Data. The SMS deliver parameters are checked to confirm that the message type indicator has the value ("SMS Deliver"), that the user data indicator has the value ("The TP-PDU field contains only the SM"), and that the data coding scheme has a supported value. The only accepted values are default alphabet, 8-bit data, Class 0 messages and Class 1 messages. Message coding errors are also checked. The extracted information is formatted into an SMS delivery-point-to-point invoke message in IS-136 format.

The message is structured as an IS-136 deliver message and contains the parameters: Message Type Indicator (set to value "SMS deliver"); Message Reference (number created by the MG and increased with each message sent); Privacy Indicator (set to value "Not Restricted"); Urgency Indicator (set to value "Very Urgent" if parameter data coding scheme indicates "Class 0 message", otherwise set to value "Normal"); Delivery Acknowledgment Request (set to value "delivery acknowledgment prohibited"); Manual Acknowledgment Request (set to value "manual acknowledgment prohibited"); Message Updating (set to value "New" (do not overwrite)"); Validity (set to value "indefinite"); Display Time (set to value "Default"); and User Data Unit. The User Data Unit parameter contains the message

and includes a Least Significant Bite Length indicating the length of the message, an Encoder Identifier set to a value "IRA" if the received message is in the GSM default alphabet and otherwise set to a value "User Specific". A Link Modifier parameter is set to value "0" and User Data Structure Type parameter is set to value "00". The user data comprising the GSM SMS message is also included. This converted message is transmitted to the TDMA network.

Referring now to FIGURE 2, there is illustrated a signaling diagram describing the forwarding of an SMS message to a GSM subscriber which is roaming within the TDMA network. The GSM service center (SC) 35 receives an SMS delivery 30. In response to the SMS delivery 30, a forward mobile termination short message invoke 40 is transmitted to the GSM SMS-GMSC 45. The SMS-GMSC 45 transmits a send routing information for short message invoke 50 to the GSM HLR 55 to retrieve routing information for the GSM subscriber 90. The send routing information for short message result 60 is transmitted back to the SMS-GMSC 45 which routes a forward short message invoke 65 to the mobility gateway 70. The mobility gateway 70 acts as a MSC with respect to the GSM network. The mobility gateway 70 further manages the location updates from a GSM subscriber roaming in a TDMA ANSI-41 network in order to know where the subscriber is currently located so that the SMS message may be properly directed.

The SMS message delivery functionality 25 within the mobility gateway 70 processes at 72 the forward short message invoke 65 to generate an SMS delivery point-to-point message 75 containing the SMS message in IS-136 format. The SMS delivery point-to-point message 75 is transmitted to the TDMA MSC/VLR 80 which forwards an SMS delivery 85 to the GSM subscriber 90.

After making the SMS delivery 85, the TDMA MSC/VLR 80 transmits an SMS delivery point-to-point return message 95 back to the mobility gateway 70. With respect to the TDMA network, the mobility gateway 70 performs as a TDMA Message Center. The mobility gateway 70 and SMS message delivery functionality 25 processes at 96 the SMS delivery point-to-point return message 95 and transmits a forward short message result 100 to the GSM SMS GMSC 45. The GMSC 45 notifies the GSM SC 35 of delivery of the SMS message via a forward mobile term short

message result 105. SMS IS-136 messages originating within the TDMA network from a roaming GSM subscriber are merely routed toward the serving MSC towards the designated ANSI-41 message center without involvement of the mobility gateway 70.

Referring now to FIGURE 3, there is illustrated a signaling diagram describing the delivery of an SMS message to a TDMA subscriber roaming within a GSM network. An SMS delivery message 110 is received at the TDMA message center 115 to initiate the process. The TDMA message center 115 transmits an SMS request invoke message 120 to the TDMA HLR 125 to determine the present location of the TDMA subscriber 165. The TDMA HLR 125 transmits an SMS request result message 130 back to the TDMA message center 115 containing subscriber location information. The TDMA message center 115 transmits an SMS delivery point-to-point invoke message 135 to the mobility gateway 140. With respect to the TDMA network, the mobility gateway 140 functions as a MSC of the TDMA subscriber. The mobility gateway 140 processes at 142 the point-to-point invoke message 135 using the SMS message delivery functionality 25 to convert the message to a forward short message invoke message 145 in GSM protocol format. The forward short message invoke message 145 is transmitted to the GSM MSC VLR 150 presently serving the TDMA subscriber 165. The GSM MSC VLR 150 performs an SMS delivery 160 to the TDMA subscriber 165. The MSC 150 notifies the mobility gateway 140 of the message delivery via a forward short message result message 155. With respect to the GSM network, the mobility gateway 140 appears as an SMS GMSC. The mobility gateway 140 converts at 156 the forward short message result message to TDMA IS-136 protocol format and forwards an SMS point-to-point return result message 170 back to the TDMA message center 115.

Using the above-described method and system, SMS messages may be seamlessly transmitted between GSM and TDMA networks. Thus, subscribers roaming outside of their home network into a network utilizing a differing technology may continue to receive SMS messages despite the fact that the network in which they are presently located utilizes an SMS message protocol different from that utilized by their home network.

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it is understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications, and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

WHAT IS CLAIMED IS:

1. An apparatus for interconnecting a first wireless communications network using a first alpha-numeric message protocol and a second wireless communications network using a second alpha-numeric message protocol to enable alpha-numeric message transmissions between the first and second wireless communications networks, comprising:

a first interface for interconnecting the apparatus with the first wireless communications network;

a second interface for interconnecting the apparatus with the second wireless communications network; and

a module responsive to receipt of alpha-numeric messages from the first and the second wireless communications networks for converting an alpha-numeric message between the first and the second alpha-numeric message protocols.

2. The apparatus of Claim 1, wherein the module further extracts alpha-numeric message related data from an alpha-numeric message from the first wireless communications network and formats the extracted alpha-numeric message related data into a second alpha-numeric message formatted according to the second protocol for the second wireless communications network.

3. The apparatus of Claim 1, wherein the first wireless communications network comprises a GSM wireless communications network and the second wireless communications network comprises a TDMA wireless communications network.

4. The apparatus of Claim 3, wherein the module further extracts alpha-numeric message related data from an alpha-numeric message from the GSM wireless communications network and formats the extracted alpha-numeric message related data into a second alpha-numeric message in IS-136 protocol for the TDMA wireless communications network.

5. The apparatus of Claim 1, wherein the module further extracts alpha-numeric message related data from an alpha-numeric message from the TDMA wireless communications network and formats the extracted alpha-numeric message related data into a second alpha-numeric message in GSM protocol for the GSM wireless communications network.

6. The apparatus of Claim 1, wherein the alpha numeric message comprises an SMS message.

7. A method for passing alpha-numeric messages between a first wireless communications network using a first alpha-numeric message protocol and a second wireless communications network using a second alpha-numeric message protocol, comprising:

receiving at a node interconnecting the first and the second wireless communications networks an alpha-numeric message formatted according to a first protocol;

converting the alpha-numeric message formatted according to the first protocol to a second alpha-numeric message formatted according to a second protocol; and

transmitting the second alpha-numeric message formatted according to the second protocol to the second wireless communications network.

8. The method of Claim 7, wherein the step of converting further comprises the steps of:

extracting alpha-numeric message data from the alpha-numeric message formatted according to the first protocol; and

formatting the extracted alpha-numeric message data into the second alpha-numeric message formatted according to the second protocol.

9. The method of Claim 7, wherein the first wireless communications network is a GSM wireless communications network and the second wireless communications network is a TDMA wireless communications network.

10. The method of Claim 9, wherein the step of converting further comprises the step of converting the Alpha-numeric message from GSM format to IS-136 format.

11. The method of Claim 9 wherein the step of converting further comprises the step of:

extracting alpha-numeric message data from the alpha-numeric message formatted according to GSM protocol; and

formatting the extracted alpha-numeric message data into the second alpha-numeric message formatted according to IS-136 protocol.

12. The method of Claim 7, wherein the first wireless communications network is a TDMA wireless communications network and the second wireless communications network is a GSM wireless communications network.

13. The method of Claim 12, wherein the step of converting further comprises the step of converting the alpha-numeric message from IS-136 format to GSM format.

14. The method of Claim 12 wherein the step of converting further comprises the step of:

extracting alpha-numeric message data from the alpha-numeric message formatted according to the IS-136 GSM protocol; and

formatted the extracted alpha-numeric message data into the second alpha-numeric message formatted according to GSM protocol.

15. The apparatus of Claim 1, wherein the alpha numeric message comprises an SMS message.

16. A method for passing alpha-numeric messages between GSM and TDMA wireless communications networks, comprising the steps of:

receiving an alpha-numeric message at a mobility gateway interconnecting the GSM wireless communications network and the TDMA wireless communications network;

if the alpha-numeric message is in a GSM format.

extracting alpha-numeric data from the alpha-numeric message;

formatting the extracted alpha-numeric data into a second alpha-numeric message in IS-136 format;

if the alpha-numeric message is in IS-136 format.

extracting alpha-numeric data from the alpha-numeric message;

formatting the extracted alpha-numeric data into a second alpha-numeric message in GSM format; and

transmitting the second alpha-numeric message.

17. The apparatus of Claim 1, wherein the alpha numeric message comprises an SMS message.

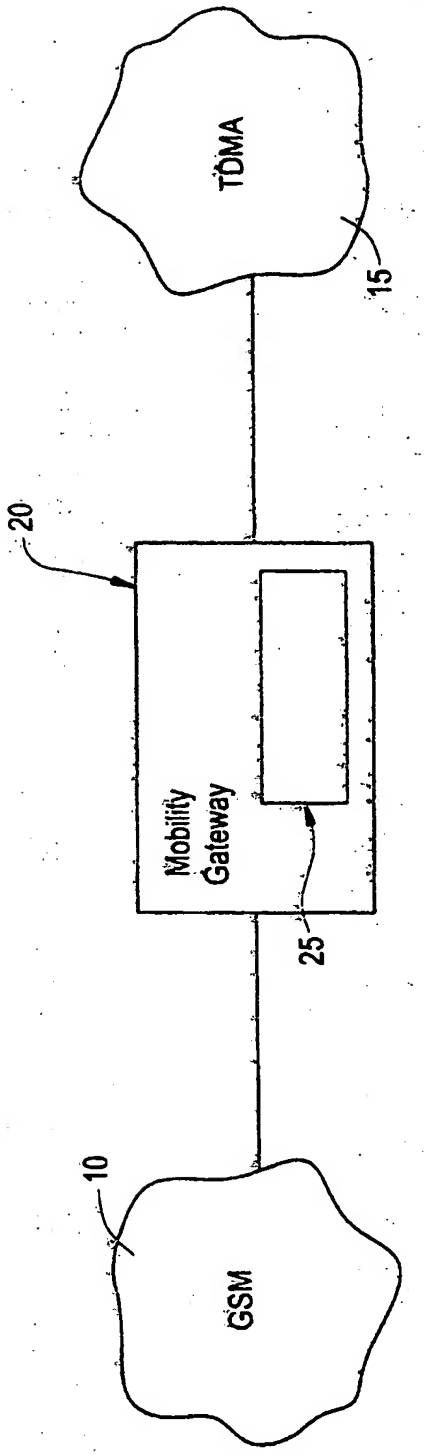


FIG. 1

FIG. 2

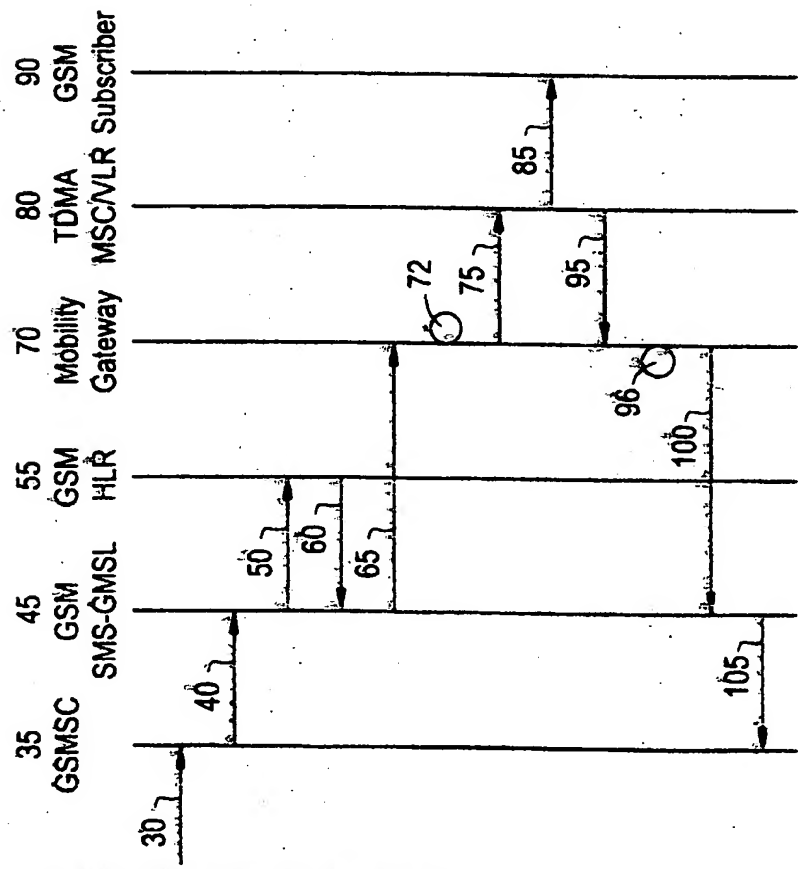
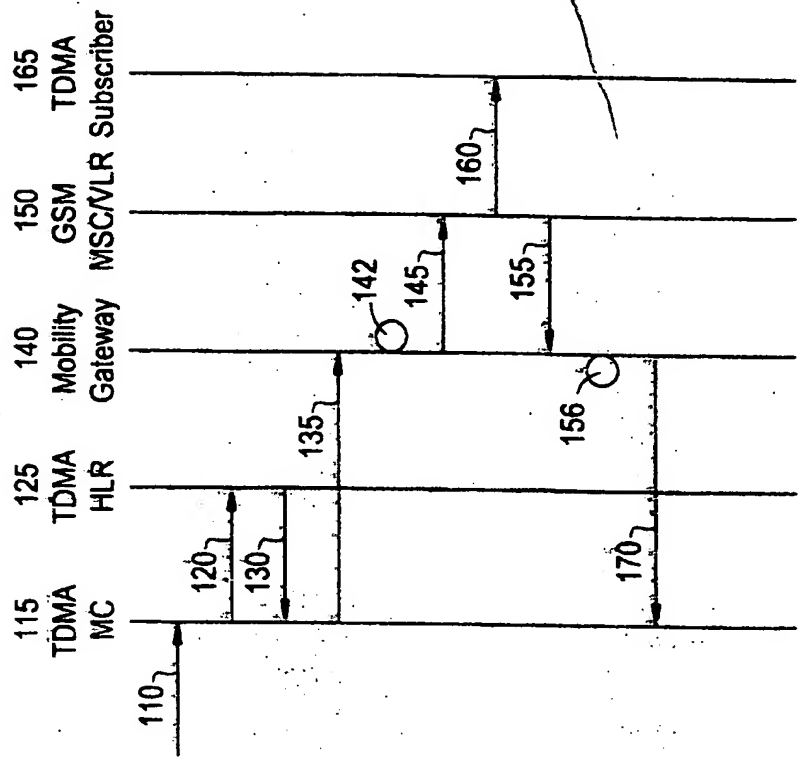

35 GSMSC
45 GSM SMS-GMSL
55 GSM HLR
70 Mobility Gateway
80 TDMA MSC/VLR
90 GSM Subscriber
30
40
50
60
65
72
75
85
95
96
100
105

FIG. 3


115 TDMA MC
125 TDMA HLR
140 Mobility Gateway
150 GSM MSC/VLR
165 TDMA Subscriber
110
120
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145
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156
160
170

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q, H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 0748064 A2 (GLOBALSTAR L.P.), 11 December 1996 (11.12.96), column 13, line 42 - column 14, line 32, figures 6-7, abstract --	1-17
P,X	WO 9933226 A1 (COVELEY, MICHAEL), 1 July 1999 (01.07.99), page 5 - page 6, abstract --	1-17

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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